

CLAIMS

We claim:

1. An apparatus comprising:
an intravascular device to perform a therapeutic treatment; and
at least one optical fiber disposed through the intravascular device, the optical fiber
configured to provide diagnostic information before, during, and after the therapeutic
treatment.
2. The apparatus of claim 1 wherein the optical fiber is exposed within a vasculature
of a patient at least at one location along the intravascular device.
3. The apparatus of claim 2 wherein the optical fiber is configured to sense vessel and
blood characteristics.
4. The apparatus of claim 3 wherein vessel and blood characteristics are selected from
the group consisting of hemodynamic characteristics, hematological parameters related to
blood and blood components and thermal parameters of the vasculature.
5. The apparatus of claim 1 wherein the intravascular device is a balloon catheter
comprising:
a catheter shaft having an elongated outer member disposed about a tubular inner
member, the tubular inner member having a lumen to receive the optical fiber
therethrough; and
a balloon coupled to a distal portion of the catheter shaft.

1 6. The apparatus of claim 5 wherein the optical fiber is coupled to the tubular inner
2 member.

1 7. The apparatus of claim 5 wherein the optical fiber is movable within the lumen.

1 8. The apparatus of claim 5 wherein the lumen is to receive an inflation medium
2 therethrough to inflate the balloon.

1 9. The apparatus of claim 8 wherein a distal tip of the optical fiber is exposed within a
2 vasculature of a patient at least at one location along the balloon catheter.

1 10. The apparatus of claim 9 wherein the optical fiber is configured to sense vessel and
2 blood characteristics selected from the group consisting of hemodynamic characteristics,
3 hematological parameters related to blood and blood components and thermal parameters
4 of the vasculature.

1 11. The apparatus of claim 5 wherein the tubular inner member has a second lumen
2 extending at least within a distal portion of the tubular inner member, the second lumen
3 being substantially parallel to the lumen having the optical fiber therethrough.

1 12. The apparatus of claim 11 wherein the second lumen is a lumen selected from the
2 group consisting of guidewire lumen, inflation lumen, radiation source lumen, drug
3 delivery lumen, atherectomy device lumen and laparoscopy lumen.

1 13. The apparatus of claim 12 wherein a distal tip of the optical fiber is exposed within
2 a vasculature of a patient at least at one location along the balloon catheter.

1 14. The apparatus of claim 13 wherein the optical fiber is configured to sense vessel
2 and blood characteristics selected from the group consisting of hemodynamic
3 characteristics, hematological parameters related to blood and blood components and
4 thermal parameters of the vasculature.

1 15. A catheter comprising:
2 a catheter shaft having an elongated outer member disposed about an tubular inner
3 member and an intraluminal gap extending longitudinally between the outer member and
4 the inner member; and
5 at least one optical fiber disposed within the intraluminal gap, the catheter capable
6 of both diagnostic and therapeutic purposes.

1 16. The catheter of claim 15 further comprises an inflatable balloon coupled to the
2 catheter shaft.

1 17. The catheter of claim 16 further comprises at least one lumen longitudinally
2 extending through the tubular inner member.

3 18. The catheter of claim 17 wherein the at least one lumen is selected from the group
4 consisting of guidewire lumen, inflation lumen, radiation source lumen, drug delivery
5 lumen, atherectomy device lumen and laparoscopy lumen.

1 19. The catheter of claim 15 wherein a distal tip of the optical fiber to contact a
2 vasculature of a patient at least at one location along the catheter.

1 20. The catheter of claim 19 wherein the at least one optical fiber is configured to sense
2 vessel and blood characteristics selected from the group consisting of hemodynamic
3 characteristics, hematological parameters related to blood and blood components and
4 thermal parameters of the vasculature.

1 21. The catheter of claim 15 wherein a distal portion of the at least one optical fiber
2 comprises a radiopaque substance.

1 22. A catheter comprising:
2 a catheter shaft having a tubular inner member coupled to an elongated outer
3 member, the catheter capable of both diagnostic and therapeutic purposes;
4 an expandable member coupled to a distal portion of the catheter shaft; and
5 at least one optical fiber coupled to the expandable member.

1 23. The catheter of claim 22 wherein the expandable member is a balloon.

1 24. The catheter of claim 23 wherein a distal tip of the optical fiber to contact a
2 vasculature of a patient at least at one location along the balloon.

1 25. The catheter of claim 24 wherein the at least one optical fiber is configured to sense
2 vessel and blood characteristics selected from the group consisting of hemodynamic
3 characteristics, hematological parameters related to blood and blood components and
4 thermal parameters of the vasculature.

1 26. An apparatus comprising:
2 a catheter comprising a catheter shaft having a lumen therein;
3 a sheath slidably disposed over the catheter shaft; the catheter shaft and the sheath
4 defining an intraluminal gap extending longitudinally therebetween; and
5 at least one optical fiber disposed within the intraluminal gap, the apparatus capable
6 of both diagnostic and therapeutic purposes.

1 27. The apparatus of claim 26 wherein a distal tip of the optical fiber to contact a
2 vasculature of a patient at least at one location along the sheath, the optical fiber
3 configured to sense vessel and blood characteristics selected from the group consisting of
4 hemodynamic characteristics, hematological parameters related to blood and blood
5 components and thermal parameters of the vasculature.

1 28. A catheter comprising:

a catheter shaft having an inner member coupled to an outer member, the catheter shaft having a lumen longitudinally therethrough;
an elongated member disposed within the lumen; and
at least one optical fiber disposed within the elongated member.

29. The catheter of claim 28 wherein the elongated member is a coil.

30. The catheter of claim 28 wherein the elongated member is a braided member.

31. The catheter of claim 28 wherein a distal tip of the optical fiber to contact a vasculature of a patient at least at one location along the elongated member, the optical fiber configured to sense vessel and blood characteristics selected from the group consisting of hemodynamic characteristics, hematological parameters related to blood and blood components and thermal parameters of the vasculature.

32. A system for sensing vessel and blood characteristics, the system comprising:
a data processing system; and
an apparatus coupled to the data processing system, the apparatus comprising an intravascular device to perform a therapeutic treatment and at least one optical fiber disposed therethrough, the optical fiber configured to provide diagnostic information before, during, and after the therapeutic treatment.

33. The system of claim 32 wherein a distal tip of the optical fiber to contact a vasculature of a patient at least at one location along the intravascular device, the optical

3 fiber configured to sense vessel and blood characteristics selected from the group
4 consisting of hemodynamic characteristics, hematological parameters related to blood and
5 blood components and thermal parameters of the vasculature.

1 34. A method of sensing vessel and blood characteristics, the method comprising:
2 inserting an apparatus into a vasculature of a patient, the apparatus comprising a
3 intravascular device to perform a therapeutic treatment and at least one optical fiber
4 disposed within the intravascular device, the optical fiber to transmit a light radiation
5 signal therethrough;
6 advancing the apparatus to a location in the vasculature;
7 operating a data processing system coupled to the apparatus to transmit a plurality
8 of light radiation signals to the location in the vasculature and a plurality of reflected light
9 radiation signals to a detector in the data processing system; and
10 processing the plurality of reflected light radiation signals to determine vessel and
11 blood characteristics.

1 35. The method of claim 34 wherein vessel and blood characteristics are selected from
2 the group consisting of hemodynamic characteristics, hematological parameters related to
3 blood and blood components and thermal parameters of the vasculature.

1 36. A method for treating intravascular conditions, the method comprising:
2 inserting a balloon catheter into a vasculature of a patient, the balloon catheter
3 comprising an inflatable balloon disposed at the distal end of a catheter shaft and at least
4 one optical fiber disposed within the balloon catheter, the balloon catheter further

5 comprising an expandable metallic structure disposed at a distal end of the catheter shaft
6 and substantially over the inflatable balloon;
7 advancing the balloon catheter to a location in the vasculature;
8 operating the balloon catheter and the at least one optical fiber within the
9 vasculature;
10 operating a data processing system coupled to the balloon catheter to provide vessel
11 and blood characteristics; and
12 inflating the inflatable balloon to expand the expandable metallic structure within
13 the vasculature.

1 37. The method of claim 36 wherein operating the data processing system is performed
2 prior, during or after inflating the inflatable balloon.

3 38. The method of claim 36 wherein the expandable metallic structure is a stent.

1 39. The method of claim 36 wherein vessel and blood characteristics are selected from
2 the group consisting of hemodynamic characteristics, hematological parameters related to
3 blood and blood components and thermal parameters of the vasculature.